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ABSTRACT:

PURPOSE: To make it possible to perform a thermal treatment in a low moisture content state and prevent an internal tissue from breaking down by reducing the moisture content of each wood with a concurrent compression procedure as a temporary setting treatment, then applying an adhesive to the surface of each wood and curing it to set temporarily an aggregation form to be finished integrally.

CONSTITUTION: After filling the press die 41 of a compression-molding device 40 with a softened wood and compressing it, the wood undergoes a compression-molding step using an excess compression method of returning the wood to a position of a specified compressibility. After that, the wood is dried by maintaining press dies 41, 42 at 150°C for one hour. The wood is taken out together with the press dies 41, 42, by holding it using a clamp, and is allowed to be temporarily set at a normal temperature. A resorcinol resin adhesive is applied to the surface of the temporarily set wood. Further, the wood in this state is subjected to the injection of vapor at the interior of a permanently setting device and is maintained under this condition at 80°C for 30 minutes for permanent setting treatment to obtain an aggregation. The internal tissue of the aggregation is prevented from breaking down by drying at the temporarily setting device and thus the qualitative improvement of the aggregation is achieved.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] About the manufacture approach of the set material which fabricated two or more thinning material etc. to one, this invention aims at destructive prevention of the internal organization of set material especially, and improves quality, and increase in efficiency of the activity by separation of a manufacturing installation, and the activity of a manufacturing installation and easy-izing of a maintenance are attained, and mass-production nature is improved, and it has, and it is quality and is related to the manufacture approach that the set material of low cost can be obtained.

[0002]

[Description of the Prior Art] Although the thinning material of a minor diameter, and the short length and the edge material which are removed in the growth process of needle-leaf trees, such as a Japan cedar and a hinoki, were generally used abundantly as a building material, since it was elasticity material essentially, fastness was low, and the limit existed naturally about the usable range from this. Especially in growth processes, such as a Japan cedar and a hinoki, it was a minor diameter tree, and since it was curving very softly in many cases, this thinning material was what can hardly be used as a building material, for example, a column etc.

[0003] Various kinds of approaches are proposed from before in order to aim at a deployment of such thinning material. For example, the adhesion shaping approach which carries out adhesion shaping of the minor diameter tree is indicated by JP,4-4,B by making adhesion area expand and holding a compression condition to hardening of adhesives after that by pressing into one, where adhesives are applied to the minor diameter tree of softened a large number. Moreover, the point of performing wood softening processing of boiling etc. is also indicated, carrying out compression maintenance of each wood with shuttering etc., in order attain plasticity-ization of wood and to perform configuration stabilization in enforcing the adhesion shaping approach of this minor diameter tree.

[0004] Moreover, after he does softening processing of two or more thinning material and applies, collects and pressurizes [heat and] adhesives in Japanese Patent Application No. No. 195548 [five to] etc. previously at two or more softened thinning material, by performing fixed processing, it excelled in the property, and the applicant for this patent crossed extensively, he is usable and has proposed the manufacture approach of the set material which is low cost etc.

[0005]

[Problem(s) to be Solved by the Invention] However, the adhesion approach of the minor diameter tree indicated by said JP,4-4,B Although it is effective in reservation of the bond strength stabilized more about the reinforcement of the minor diameter tree of unified a large number In order to heat-treat in the condition with many moisture contents of a minor diameter tree, without performing special processing of reducing the water content of each minor diameter tree in attaining configuration stabilization of the major-diameter tree obtained, it was easy to generate destruction, and a crack and a blowout in the internal organization of wood, and the problem was in degradation of the quality accompanying this.

[0006] Moreover, the set material by the manufacture approach indicated by Japanese Patent

Application No. No. 195548 [five to] is usable in the range large as a building material by the outstanding property. However, it is necessary to perform processings various with the same equipment with a press function in a proof-pressure container except the heat-treatment which softens thinning material. Therefore, the above-mentioned proof-pressure container is enlarged from it being necessary to secure a press stroke, consequently affects the thermal efficiency in fixed (heating) processing. Moreover, the burden which becomes expensive since a device becomes complicated, and starts the activity and maintenance also became heavy, and the above-mentioned equipment was not able to contribute to remarkable progress of mass-production nature in connection with these.

[0007] While this invention can be made in order to solve the conventional trouble mentioned above, it can aim at destructive prevention of the internal organization of set material and can improve quality, increase in efficiency of the activity by separation of equipment and easy-ization of a maintenance of a manufacturing installation are attained, and it can improve and it has mass-production nature, and it is quality and it aims at providing the manufacture approach which can be acquired in the set material of low cost.

[0008]

[Means for Solving the Problem] Invention which relates to claim 1 in order to attain said purpose The 2nd process which performs fixed processing temporarily the water content of each wood is temporarily reduced, performing compression-molding processing with predetermined compressibility after **** (ing) each softened wood to the same grain direction, the 1st process which performs softening processing of two or more wood, and, It considers as the configuration which consists of the 3rd process which performs spreading processing of adhesives on the front face of each wood fixed temporarily, and the 4th process which performs permanent fixation processing of an aggregate configuration while hardening the adhesives applied to each wood, unifying each wood and forming the aggregate.

[0009] At this time, by the compression-molding processing performed in the 2nd process of invention concerning said claim 1, after carrying out the overcompression of said each wood based on compressibility higher than said predetermined compressibility, it is carried out by being returned to predetermined compressibility. Moreover, by fixed processing, cooling is similarly performed after desiccation of said each wood temporarily. Furthermore, fixed processing is similarly performed through the same compression-molding equipment temporarily with compression-molding processing. Moreover, in the permanent fixation processing performed in the 4th process of invention concerning said claim 1, heating of said each wood is performed through steam under pressure.

[0010]

[Function] In invention of claim 1 which has said configuration, softening processing of two or more wood (for example, thinning material) is performed in the 1st process. In compression-molding processing of the 2nd process mentioned later, softening processing is performed here in order to make deformation of wood easy. After ****(ing) each continuing wood which was softened in the 2nd process to the grain direction same in metal mold, it has, predetermined compressibility, i.e., predetermined configuration, and compression-molding processing is performed to one. Furthermore, fixed processing is performed temporarily the water content of each wood in the condition of having been held with the predetermined configuration at one is temporarily reduced. That is, the moisture content inside each wood (water content) is reduced even to a predetermined value, and a configuration is fixed temporarily.

[0011] After carrying out the overcompression of each wood in compression-molding processing based on compressibility higher than predetermined compressibility, the approach of returning gradually is effective in predetermined compressibility. According to this approach of carrying out an overcompression, compared with the case where only predetermined compression is performed, compaction of the time amount which water content of each wood can be lessened more and decline in water content takes in fixed processing temporarily is possible. It is effective in the approach of heating each wood and drying reducing water content by fixed processing temporarily. According to the approach by this desiccation, the water content of each wood is decreased to a value (value usually higher than the water content in drying temperature) fixable in a room temperature temporarily.

Moreover, cooling each wood compulsorily to a room temperature after that has a configuration effective in obtaining the wood fixed temporarily at an early stage. The great portion of time amount which fixed processing takes temporarily is a cooldown delay of each seasoned wood, and since it serves as long duration, it becomes rate-limiting [the production time of set material]. Therefore, compulsory cooling can shorten the production time of set material sharply.

[0012] It is possible to carry out through compression-molding equipment with the fixed processing same temporarily with compression-molding processing. If this same equipment performs, since fixed processing can be performed temporarily, with the configuration in compression-molding processing held, each wood excellent in dimensional stability and configuration stability fixed temporarily can be obtained easily.

[0013] Furthermore, in the 3rd process after the 2nd process is completed, spreading processing of adhesives is performed on the front face about each wood by which fixed processing was carried out temporarily, with the configuration in compression-molding processing held. Adhesives bind each wood here mutually and it is for unifying.

[0014] Finally, in the 4th process, the configuration in compression-molding processing is held and each wood with which adhesives were applied is heated through steam under pressure. Permanent fixation processing is performed at the same time the aggregate with which adhesives hardened and each wood was united with the predetermined configuration by this is formed. As mentioned above, the set material eternally fixed in the configuration is manufactured.

[0015] The set material manufactured by invention of said claim 1 will be in the condition that the water content of each wood is low in order to dry in this processing by introducing fixed processing temporarily, and in permanent fixation processing, destruction of the internal organization of the aggregate by heating of steam under pressure etc. will not take place. It becomes possible to improve the quality of set material by this. Moreover, each wood by which fixed processing was carried out temporarily becomes possible [once bringing together in somewhere else and keeping it]. Therefore, by performing fixed processing and permanent fixation processing with separate simple equipment temporarily, when the same equipment performs fixed processing and permanent fixation processing temporarily, it is generated inevitably, for example, it comes to be able to perform excluding the futility about the volume or heat, and use of the existing facility, and becomes that the increase in efficiency of an activity and easy-izing of a maintenance of a manufacturing installation are possible. it becomes possible to improve mass-production nature by this, and set material and its production cost can be boiled markedly, and can be held down low.

[0016] Next, the set material concerning this invention is explained based on drawing 1 . After drawing 1 was the perspective view showing set material typically, compression-molding processing of both two or more thinning material 2 (the set material 1 of drawing 1 5) by which softening processing was carried out is carried out at one and fixed processing of the set material 1 is further carried out in drawing 1 temporarily, it comes to carry out permanent fixation processing, making adhesives 3 intervene between the thinning material 2. The thinning material from which each thinning material 2 was removed in growth processes, such as a Japan cedar and a hinoki, is used here, and, as for each thinning material 2, the thinning material 2 about 15cm and whose tip end 2B tip-diameter 2A is about 10cm and to which the path was comparatively equal is used.

[0017] As a concrete class of thinning material 2 used, a Japan cedar, a cypress, a Japanese red pine, A clo pine, a larch, HIMEKOMATSU, Picea jezoensis, Abies sachalinensis, a Japanese umbrella pine, A Spanish mackerel, a fir, Khiva, NEZUKO, INUMAKI, a hemlock, kaya, a toga Spanish mackerel, KIRI [SHIOJI, KUSU and] Ms. [needle-leaf trees or zelkovas, such as a yew, and] -- a Japanese oak and a chestnut -- AKAGASHI, SHIRAKASHI, the Japanese oak, an oyster, Buna, Castanopsis, YACHIDAMO, a linden, SAWAGURUMI, Fraxinus lanuginosa, ITAYAKAEDE, Prunus jamasakura Sieb. ex Koidz, an alder, CHISHANOKI, a buckeye, a Japanese poplar, a hophornbeam, Machilus thunbergii, a hull elm, demon GURUMI, KATSURA, Magnolia hypoleuca, Betula grossa, Belula maximowicziana Regel, ISUNOKI, YAMAGUWA, dog ENJIE, Kalopanax, and HIROHANO, although broad-leaved trees, such as a yellowfin tuna, SHIURIZAKURA, Betula maximowicziana, and

KEMPONASHI, are suitable Ms. [a Japan cedar, a cypress, pines, a zelkova, the Japanese oak, and] -- a Japanese oak and Buna are desirable as an ingredient of this application also in respect of abrasion resistance also in design.

[0018] As a product from a foreign country, moreover, a teak, dirt lauan, NATO, CHAMPAKA, comics SHINORO, PEKURU, DAO, a phone red sandal tree, a rosewood, an ebony, a durian, KAMERERE, PAROSAPISU Mel Sawa, Ramin, and a tapir -- CHIKAN, KAPORU, and the genus meranti -- RAJIATAMATSU, TAIHI, Agathis, an apitong, a Chinese quince, the New Guinea walnut, The Queensland walnut, a monkey pot, a silky oak, TAMAKURA, Brazi LeAnn Lowe's, MORADO, mahogany, Cobh Lil, Prima Bella, A bitter taste Japan cedar, a black walnut, spruce, a KURARO walnut, A bay Japan cedar, BEIHI, Pseudotsuga taxifolia, a zebra, UENJI, Mann Sonia, IROKO, The tree of MAKORE, satin wood, AFARA, ABURA, IJIGUBO, SAPERI, a homme, IROMBA, WAWABIMA, BUBINGA, DANTA, an OBAN call, a black bean, YAKARU, a jelutong, ASAMU, Gen Cong, SEPECHIRU, MATOA, and rubber is suitable. this invention -- especially -- Ms. [a pine, a cypress, a Japan cedar, a zelkova, the Japanese oak, and] -- a Japanese oak and Buna are suitable. This reason is that these tree species heat and it is easy to soften.

[0019] In this invention, a cane can be used similarly. A cane can remain, where the compression set also of a ground tissue or the pattern of ***** is similarly carried out like the annual rings of wood. As a class of cane, although Phyllostachys pubescens, a common Japanese bamboo, a black bamboo, a black bamboo, ****, ****, the Hakone bamboo, *****, Kanchiku, etc. are suitable for use, Phyllostachys pubescens, a common Japanese bamboo, and a black bamboo have points, such as reinforcement and resiliency, to the widely desirable application range. Moreover, it is most desirable to perform softening of a cane in boiling water. The reason is that excess oil can be removed effectively, the adhesive property by adhesives improves as the result, and a degree of hardness and reinforcement also increase.

[0020] Moreover, each softened thinning material 2 deforms more than imagination, it becomes easy to enter a mutual narrow clearance, and many properties can be freely changed by changing various predetermined compressibility. Furthermore, it can be made to be able to compound with plastic material, such as ceramic ingredients, such as metallic materials, such as aluminum and iron, an alumina and silicon nitride, a carbon fiber, silicon carbide fiber, and an alumina silicate fiber, nylon, and Dacron, and can adjust freely also about reinforcement or thermal resistance.

[0021] As each thinning material 2 is shown in drawing 1 , a grain direction is ****(ed) similarly, and when the thinning material 2 is arranged so that tip-diameter 2A may be on an end-face side, the thinning material 2 on a par with the thinning material 2 is arranged so that the tip end 2B may become the end-face side of the set material 1. Thus, if each thinning material 2 is arranged, in the set material 1 manufactured, it becomes impossible that a clearance is further hard to be generated between each thinning material 2, and the set material 1 of uniform pressed density can be obtained, the activity about spreading processing of adhesives 3 can be done easy, and the amount of the adhesives 3 used can be saved.

[0022] Adhesives 3 are for making each thinning material 2 bind mutually, and various kinds of adhesives can be used for them as adhesives used by this invention. For example, thermosetting adhesives, such as phenol system adhesives which use phenol resin as a principal component, and resorcinol system adhesives which use resorcinol resin as a principal component, are used, and it is suitable. In addition, as thermosetting adhesive, the melamine system adhesives which use melamine resin as a principal component, the urea system adhesives which use a urea-resin as a principal component, the epoxy system adhesives which use an epoxy resin as a principal component can be used. Moreover, water based polymer isocyanate adhesive, polyvinyl acetate adhesive, etc. which use isocyanate and an aqueous giant molecule as a principal component in addition to this thermosetting adhesive are usable. It is desirable to face to choose the adhesives 3 to be used, and to take into consideration and choose the cost of adhesives 3, the class of solvent, the application of the set material 1, etc. here.

[0023] Then, the manufacture approach of manufacturing the set material 1 constituted as mentioned

above is explained. This manufacture approach performs compression-molding processing to one with predetermined compressibility, after ****(ing) each thinning material 2 which performs softening processing of two or more thinning material 2 and which was softened the 1st process to the same grain direction. It consists of the 2nd process which performs fixed processing temporarily the water content of each thinning material 2 is temporarily reduced, and the 4th process which performs permanent fixation processing of the configuration of each thinning material 2 by which spreading processing was carried out the 3rd process with which spreading processing of adhesives 3 is performed on the front face of each thinning material 2 fixed temporarily.

[0024] First, the softening (heating) processing performed at the 1st process is concretely explained based on drawing 2 - drawing 4. The explanatory view showing typically the condition that drawing 2 heat-treats each thinning material 2 with steam heating apparatus here, the explanatory view showing typically the condition that drawing 3 heat-treats the thinning material 2 by boiling in the tank which filled boiling water, and drawing 4 are the explanatory views showing typically the condition of heat-treating the thinning material 2 with high-frequency-heating equipment.

[0025] How to heat-treat with the steam heating apparatus shown in introduction and drawing 2 is explained. The steam heating apparatus 10 has the cylinder-like heating container 11, and the steam injection tip 12 (left-hand side in drawing 2) which injects a heating steam inside, and the exhaust port 13 (drawing 2 Nakagami side) which discharges an internal heating steam to a way outside the steam heating apparatus 10 are established in this heating container 11. In this steam heating apparatus 10, the interior and atmospheric air of equipment 10 are opened for free passage through the exhaust port 13. Moreover, the laminating of two or more thinning material 2 is carried out to the interior of the steam heating apparatus 10 through the diaphragm 14 in between. Each diaphragm 14 achieves the operation positioned so that each thinning material 2 may not move within equipment 10.

[0026] The temperature up of the inside of equipment 10 is carried out to 70 degrees C - 160 degrees C with the heating steam injected in equipment 10 from the steam injection tip 12 here. It is about 1 kgf/cm² preferably. It is intermittently injected with a steam atmospheric pressure, and the temperature in equipment 10 is held at about 80 degrees C - 100 degrees C. Moreover, heating time is set up in about 6 hours.

[0027] In order to heat-treat each thinning material 2 with such steam heating apparatus 10, after carrying out the laminating of two or more thinning material 2 into equipment 10 through each diaphragm 14, a heating steam is intermittently injected from the steam injection tip 12. Thus, while having injected the heating steam, each thinning material 2 is softened in homogeneity.

[0028] Next, how to perform heat-treatment according each thinning material 2 to boiling is explained based on drawing 3 in boiling water. In drawing 3 R> 3, boiling water 21 is filled by the tank 20 and it is immersed into this boiling water 21 in the networks 22, such as a wire gauze at which it comes to put in two or more thinning material 2. Moreover, a lid 23 is attached to a tank 20. This lid 23 is for blockading the upper part of a tank 20 and making it the temperature of the boiling water 21 in a tank 20 not fall at the time of heat-treatment of each thinning material 2.

[0029] Above 60 degrees C, as long as the boiling water 21 filled by the tank 20 here is good to set temperature as the range of 90**5 degrees C if long duration processing is considered, although it is good to a boiling water and it is required for it, it may install a heater inside, and it may perform temperature control. Moreover, about about 1 - 6-hour time amount is required for the heating time of each thinning material 2.

[0030] In order to heat-treat each thinning material 2 using such a tank 20, after filling the boiling water 21 heated by 90**5 degrees C in the tank 20, the network 22 into which each two or more thinning material 2 was put is put in in a tank 20 through a crane etc., and it is immersed in boiling water 21. And after blockading the upper part of a tank 20 with a lid 23, heat-treatment of about 1 - 6 hours is performed. This softens each thinning material 2 in homogeneity.

[0031] In heat-treatment by boiling mentioned above, the insidious curing catalyst (for example, aquosity type KYATA knitting (product made from Japanese east chemistry)) of marketing to which hardening is urged acts. In addition, at the temperature of 100 degrees C or more If the water-soluble

adhesives of amino resin, such as adhesives which demonstrate adhesive ability, for example, urea, and a melamine, are melted into boiling water 22, spreading processing of the adhesives 3 of the 3rd subsequent process can be omitted, and the fixed processing of it will be immediately attained with compression-molding processing with a common hotpress temporarily. Then, what is necessary is just to carry out permanent fixation processing with an ordinary autoclave. This manufacture approach can use the existing facility and is economically excellent.

[0032] Furthermore, how to heat-treat each thinning material 2 with high-frequency-heating equipment is explained based on drawing 4. In drawing 4, high-frequency-heating equipment 30 has the electrode plate 32 which was brought into two or more steps and arranged in the interior of the body 31 of equipment, and two or more thinning material 2 is laid on each electrode plate 32. Moreover, the RF oscillation machine 33 is formed in the upper part of the body 31 of equipment, and the control unit 34 for controlling the RF oscillation machine 33 is further attached to the flank (left-hand side section in drawing 4) of the body 31 of equipment.

[0033] The frequency of the RF oscillated from the RF oscillation machine 33 is set up here by 13.56MHZ(s), and the output is set to 600W. Moreover, the time amount of the high-frequency induction heating performed by this RF oscillation machine 33 is set up in about 1 hour.

[0034] In order to heat-treat each thinning material 2 with such high-frequency-heating equipment 30, each two or more thinning material 2 is laid on each electrode plate 32 arranged in the body 31 of equipment, and the RF oscillation machine 33 is driven after this under the condition mentioned above through the control unit 34. Thereby, each thinning material 2 is heated by the RF emitted from the RF oscillation machine 33, and is softened in homogeneity.

[0035] Then, each thinning material 2 which carried out softening processing of the 2nd process is explained about the 2nd process which performs fixed processing compression-molding processing and temporarily based on drawing 5 and drawing 6. The explanatory view and drawing 6 which show typically the condition before drawing 5 performs compression-molding processing of each thinning material 2 here with compression-molding equipment are the explanatory view showing typically the condition of performing fixed processing the condition that compression-molding equipment performs compression-molding processing of each thinning material 2, and temporarily.

[0036] First, the configuration of the compression-molding equipment 40 used for the 2nd process is explained based on drawing 6. In compression-molding equipment 40, the press metal mold 41 is installed in the interior. Into the press metal mold 41, each two or more thinning material 2 by which pressurization compression is carried out is ****(ed) and laid by the same grain direction. Moreover, in order to make the outside whole surface of the press metal mold 41 dry each laid thinning material 2, planar heating elements 45 (for example, heat carriers, such as an electrical heater, steam, or oil etc.) are attached. Furthermore, two or more evaporation holes 47 are formed in the press metal mold 41 and a planar heating element 45, and the steam generated from the thinning material 2 and moisture pass from each evaporation hole 47 to them.

[0037] The press cylinder 44 is installed in the upper part location of compression-molding equipment 40. The press metal mold 42 is connected and installed in the press cylinder 44 bottom through the press rod 43. In case this performs compression-molding processing mentioned later, the press rod 43 is caudad moved through the press cylinder 44, and the press metal mold 42 pressurizes each thinning material 2 from the upper part with migration of this press rod 43. Moreover, in order to make the top whole surface of the press metal mold 42 dry each thinning material 2 laid into the press metal mold 41, planar heating elements 46 (for example, heat carriers, such as an electrical heater, steam, or oil etc.) are attached. Furthermore, two or more evaporation holes 48 are formed in the press metal mold 42 and a planar heating element 46, and the steam generated from each thinning material 2 passes from each evaporation hole 48 to them. The pressures done here by the press rod 43 from the press cylinder 44 constituted in this way are [% / of compressibility / 15 kgf/cm² and / 30] 10 kgf/cm² in 50% of compressibility, for example, although changed according to the compressibility of each thinning material 2. It is set up.

[0038] As mentioned above, the compression-molding equipment 40 constituted is used, and

compression-molding processing is performed about two or more thinning material 2 which carried out softening processing. First, two or more thinning material 2 which carried out softening processing is ****(ed) and laid in the same grain direction within the press metal mold 41. Thus, in case each thinning material 2 is ****(ed) and laid, each thinning material 2 to which the path was comparatively equal as mentioned above bearing in mind the annual-rings pattern N which appears in the end face 4 of the set material 1 is used, and each thinning material 2 from which a path differs is used mutually. By performing this consideration, it becomes possible to change variously the annual-rings pattern N which appears in the end face 4 of the set material 1, and to discover peculiar design-effectiveness.

[0039] Then, according to predetermined compressibility, compression-molding processing is performed in each thinning material 2. In this compression-molding processing, first, through the upper press cylinder 44, pressurization migration of the press rod 43 is carried out, and, thereby, the press metal mold 42 carries out pressurization compression of each thinning material 2 with a predetermined pressure from the upper part. Since each thinning material 2 is in a softening condition at this time, it is compressed more easily than each press metal mold 41 and 42. As shown in drawing 6, after the press metal mold's 42 moving, it stops to location A-A' corresponding to predetermined compressibility.

[0040] At this time, after carrying out the overcompression of each thinning material 2 based on compressibility higher than predetermined compressibility, the processing returned gradually is also effective in predetermined compressibility. After carrying out compression-molding processing, although there is reduction in some, since it still contains many moisture, each thinning material 2 which is high water content causes long duration-ization of desiccation by fixed processing temporarily which is mentioned later. Then, compaction of the drying time which makes water content low, namely, lessens the moisture inside [thinning material 2] each, and is mentioned later is aimed at by carrying out the overcompression of each thinning material 2. Moreover, it is because there is a possibility that a crack etc. may go into the interior of each thinning material 2, and reinforcement etc. may fall when moving the press metal mold 42 gradually returns the press metal mold 42 to a position (compressibility) immediately in the condition that the internal stress of each thinning material 2 is high. As shown in drawing 6, after specifically carrying out an overcompression based on compressibility (for example, being about 60% location B-B') higher than predetermined compressibility (for example, being about 30% location A-A'), it is the processing gradually returned to predetermined compressibility.

[0041] Then, momentary fixed processing of each thinning material 2 is performed using said compression-molding equipment 40. Fixed processing is forming hydrogen bond between the molecules of the component to constitute, and fixing temporarily a predetermined configuration, i.e., the configuration at the time of compression-molding processing, by making low water content of each thinning material 2 temporarily. As shown in drawing 6, it is in the condition that the press metal mold 42 at the time of the compression-molding processing mentioned above was held at location A-A' corresponding to predetermined compressibility, and, specifically, water content is made low by drying each thinning material 2. Desiccation is performed by heating each press metal mold 41 and 42 through planar heating elements 45 and 46, respectively. The steam of each thinning material 2 which evaporates at the time of desiccation, and moisture are passed outside through each evaporation holes 47 and 48.

[0042] Since there is a possibility that a strong fall, discoloration, etc. may occur when it dries in long duration at an elevated temperature although whenever [stoving temperature] is so effective that it is high as conditions which perform desiccation mentioned above at this time, although based also on the magnitude of each thinning material 2, about 150 degrees C is desirable. Moreover, as for the standard which desiccation ends, it is desirable for the water content of each thinning material 2 to become 35% or less which is the upper limit of the water content which can fix a configuration temporarily in 30 degrees C (room temperature) for the reason explained in the conditions of cooling mentioned later.

[0043] Furthermore, after desiccation is completed, it is effective in compaction of the time amount which fixed processing takes temporarily to cool the thinning material 2 compulsorily. As shown in drawing 6, it is in the condition that the press metal mold 42 at the time of the compression-molding processing mentioned above was held at location A-A' corresponding to predetermined compressibility,

50. Therefore, in treating the thinning material 2 in large quantities, it excels very much activity-wise and economically, and it is suitable for mass-production nature.

[0049] Next, the configuration of the permanent fixation equipment 70 used for the 4th process is explained based on drawing 8. Permanent fixation equipment 70 has the body 71 of permanent fixation equipment which consists of a cylinder-like proof-pressure container, and the steam injection nozzle 72 of a pair is arranged in the way upper part along with the longitudinal direction of the body 71 of permanent fixation equipment among the bodies 71 of permanent fixation equipment. It connects with the boiler which is not illustrated, and the steam under pressure heated from the boiler at the time of permanent fixation processing is supplied to each steam injection nozzle 72, and each steam injection nozzle 72 performs internal heating of the body 71 of permanent fixation equipment. Moreover, into permanent fixation equipment 70, where [51 (condition holding the configuration in compression-molding processing)] 4th page other than end-face 4 is held by the clamp 50, the laminating of two or more thinning material 2 is carried out through the diaphragm 73 in between. Each diaphragm 73 achieves the operation positioned so that the thinning material 2 (aggregate 49) held by the clamp 50 may not move by 70 in equipment. Since permanent fixation equipment 70 can heat a lot of thinning material 2 (aggregate 49) at once, it is excellent about thermal efficiency and fits mass-production nature.

[0050] Although the temperature of the heated steam is 130 degrees C thru/or 200 degrees C as conditions which perform permanent fixation processing mentioned above at this time, 180 degrees C is desirable and 16 kgf/cm² and the processing time are set up for a water vapor pressure in about 30 minutes, respectively. Moreover, permanent fixation processing mentioned above can be performed also by heating the inside of the body 71 of permanent fixation equipment at a heater etc. That is, permanent fixation processing of the aggregate 49 is performed by carrying out energization heating of the heater and carrying out predetermined time maintenance of the condition of having heated the interior of the body 71 of permanent fixation equipment to predetermined temperature. the time of performing permanent fixation processing mentioned above at this time -- a heater -- the internal temperature of the body 71 of permanent fixation equipment -- 130 degrees C -- or heating control is carried out by 200 degrees C so that it may hold at 180 degrees C preferably, and the permanent fixation processing time is set up in 20 hours.

[0051] After the permanent fixation processing mentioned above is completed, the set material 1 explained by drawing 1 is obtained.

[0052] Thus, in the end face 4, the peculiar large annual-rings pattern N of design-effectiveness remains, therefore the manufactured set material 1 cuts the set material 1 in the direction of a path of each thinning material 2, forms a plate, and when this plate is used as facing of a product, it can use it for various kinds of products of the very large range. moreover, the cross wood grain which cuts the set material 1 in the die-length direction of each thinning material 2, and appears in the side face -- a pattern, straight-wood-grain patterns, or those patterns that it was intermingled are also large, and design-effectiveness can use them for various kinds of products of the large range.

[0053] As mentioned above, the set material 1 manufactured is processed into a plate etc. with remaining as it is, a cutter, a grinder, etc., and the following products are mentioned as an usable product. For example, it can be used for a column, a digit, a beam, a bracing, a foundation, the butt strap for walls, the internal-corner material for walls, a core print, a head-lining ceiling cornice, large undertaking, a joist receptacle, a floor post, the tread for stairways, nose hiding, a ridge pole, etc. as a structural configuration member. As building materials and a structural opening member, moreover, the upper frame for a door and doors, the underframe for doors, The vertical stile for doors, the upper frame for glass doors, the underframe for glass doors, the vertical stile for glass doors, the middle rail for glass doors, the push edge for glass doors, a louver door, and the object for louver doors -- a web and the stile for wheat bran -- The upper frame for window screens, the underframe for window screens, the vertical stile for window screens, the middle rail for window screens, the push edge for window screens, A fan window, the frame for doors, the cope box for doors, the drag flask for doors, the door post for doors, the doorstop for doors, The frame for sliding doors, the cope box for sliding doors, the drag flask for

and after drying each thinning material 2, specifically, each thinning material 2 is cooled from metal mold 41 and 42. Cooling of each press metal mold 41 and 42 performs [piping] through cooling water or air inside for each delivery by cooling compulsorily.

[0044] At this time, as conditions which perform cooling mentioned above, the internal temperature of each thinning material 2 to which water content fell to 35% or less by desiccation is cooled until it becomes 30 degrees C or less (near a room temperature). Although drying temperature is based also on the magnitude of each thinning material 2, it is carried out near 150 degree C, but in such a pyrosphere (100 degrees C or more), unless water content falls to 15% or less, in drying temperature, a configuration is temporarily unfixable. Then, when maintaining the condition that the press metal mold 42 was held at location A-A' corresponding to predetermined compressibility, till cooling termination. Even if water content does not reach by 15% or less, recovery of the configuration in the pyrosphere in drying temperature can be prevented, and it makes it possible to fix each thinning material 2 to the condition that compression molding was carried out to one in the predetermined configuration, i.e., compression-molding processing, temporarily. Moreover, this actuation makes reducible the drying time until water content becomes 15% or less from 35%. Therefore, the time amount which fixed processing takes temporarily when the production time of the set material 1 is rate-limiting can be sharply shortened by compaction of the cooldown delay by forced cooling mentioned above, and reduction of this drying time.

[0045] After cooling is completed, the press rod 43 is moved up through the press cylinder 44, and, thereby, the press metal mold 42 is moved up. Then, each thinning material 2 in the press metal mold 41 is taken out besides compression-molding equipment 40. Since a configuration is fixed temporarily and it is cooled by 30 degrees C or less in fixed processing temporarily, each taken-out thinning material 2 is easy handling. Therefore, it is possible to keep the taken-out thinning material 2 in large quantities, and since a lot of thinning material 2 can be supplied to the permanent fixation processing therefore mentioned later, it is suitable for mass-production nature. Moreover, the dry material which is the thinning material 2 fixed temporarily can also be obtained at an early stage as a product of another application.

[0046] Next, when spreading processing of the adhesives 3 of the 3rd process is explained, they are 250g - 300 g/m² to the front face of each thinning material 2 on which the configuration was temporarily fixed at the 2nd process. It applies with spray equipment and the brush which do not illustrate the resorcinol resin adhesive of extent.

[0047] Furthermore, the 4th process which performs permanent fixation processing of the thinning material 2 in which the configuration was fixed temporarily is explained based on drawing 7 and drawing 8. They are the explanatory view showing typically the condition that drawing 7 held in the condition which held the configuration in compression-molding processing for the configuration of the thinning material 2, i.e., a predetermined configuration, here, and the explanatory view showing typically the condition of performing permanent fixation processing of the thinning material 2 where drawing 8 is held in a predetermined configuration in permanent fixation equipment.

[0048] Permanent fixation processing is processing which opens wide the elastic energy which the configuration accumulated according to the deformation in the time of compression-molding processing into each thinning material 2 fixed temporarily with heating, fixes the configuration of each thinning material 2 eternally, and obtains the set material 1. Since each thinning material 2 is temporarily accompanied by the etholung of deformation with heating, like drawing 7, by the clamp 50, it is changed into the condition 51 that 4th page other than end-face 4 was held, and is heated. Moreover, the maintenance by the clamp 50 changes into the condition of having held the configuration in compression-molding processing each thinning material 2 which applied adhesives 3, and makes the aggregate 49 form by hardening of the adhesives 3 by heating. Therefore, it becomes possible to change variously the annual-rings pattern N which appears in the end face 4 of the set material 1, and to discover peculiar design-effectiveness. Furthermore, the clamp 50 is cheap, and the maintenance by the clamp 50 is an easy activity, and can hold at once many things in the condition 51 of having held two or more thinning material 2 in the configuration in compression-molding processing, by the same clamp

sliding doors, the door post for sliding doors, a double sliding window frame, the cope box for double sliding windows, The drag flask for double sliding windows, the door post for double sliding windows, a rotation window frame, the cope box for pivoted windows, the drag flask for pivoted windows, It can be used for the end plate for the plate for the frame for the door post for pivoted windows, a fixed-frame-type-window frame, the cope box for fixed frame type windows, the drag flask for fixed frame type windows, the door post for fixed frame type windows, and window frames, a sliding shutter, and sliding shutters, the upper frame for sliding shutters, the underframe for sliding shutters, the vertical stile for sliding shutters, the cope box for sliding shutters, the drag flask for sliding shutters, the door post for sliding shutters, a door pocket, and door pockets etc.

[0054] Moreover, it can be used for a tile, a mosaic tile, a floor plate, a crown plate, a wall board, etc. as structural *****. Furthermore, it can be used for the cap piece for the stanchion for the aperture balustrade in an assembly house etc., the plane lattice for apertures, a stairway, a stairway balustrade, and balustrades, a balcony, a veranda, a gate, a gatepost, a gate, a wall, and walls etc. As furniture, moreover, a bed, a chair, a rocking chair, a sofa, a bench, a legless chair, A outdoor bench, the foot for chairs, a desk, a bookrest, a tatami-room table, a table, a conference desk, a table foot, A counter, a television base, a flowerpot, a service wagon, a wardrobe, a cabinet, a corner cabinet, a sideboard, a cupboard, and an arrangement shelf -- hanging -- a cupboard, a shoe cupboard, and the cabinet for daily necessities -- It can be used for a dresser, the inviter for furniture, Toride for furniture, the tongue for furniture, the shelf board for furniture, etc., and can be used for the hanger for garments, a magazine-rack, a newspaper rack, an umbrella stand, slippers ON **, etc. as indoor small arrangement tools.

[0055] In addition, circumference articles of the body, such as *****, a cane, a fan bone, a fan bone, and a glasses frame, a sandals base, Makeup and hairdressing tools, such as footwear, such as a wooden-clogs base, a pipe for smoking, and a comb, the carbon button for garments, Wash / cleaning tools, such as upholsteries, such as a flower vase, a basin, and a frame, a tub, and a washboard, Containers for - eating and drinking for cooking, such as a nest of boxes, a flat wooden spoon, Shakushi, a cutting board, the shank for kitchen knives, The instrument and eating-and-drinking tools for cooking, such as a shank of the spoon for eating and drinking, a household Shinto altar, an image of a deity, a Buddhist altar, Congratulations-and-condolences supplies, such as a rosary and a sutra desk, the bamboo hat for dome lights, head-lining lowering *****, head-lining direct attachment *****, The heating and cooling or the air-conditioning ventilator machine of lighting fitting, such as *****, wall direct attachment *****, and a bamboo hat for table lamps, a hibachi, etc., the cover for an organ bath and organ baths, the shower head, and the object for organ baths -- plumbing equipment supplies, such as a drainboard, -- Play amusement supplies, such as *****, an assembly play implement, and blocks, a tennis racket frame, Athletic-sports supplies, such as a ping-pong bat, a badminton racket frame, and a head for golf clubs, A writing implement and office tools, such as mark material, a slide rule, an abacus, a drawing board, a drawing table, a pencil case, *****, and a pen tray, footwear -- canna, such as pallets for transportation, such as a tag and a doorplate, and a sleeper, -- it can be used for temporary-works supplies, such as the door frame for scaffolds and the stanchions for scaffolds, such as a base and a shank for saws, a scaffold manual grinding column, a plate for scaffolds, and concrete shuttering, etc.

[0056] After the manufacture approach of the set material 1 which starts this invention as explained to the detail above carries out fixed processing of each thinning material 2 temporarily, it holds a configuration eternally and carries out permanent fixation processing. destruction of the internal organization of the set material 1 produced with heating performed by this in case a configuration is fixed etc. can be prevented, and the quality about the mechanical property of the set material 1, a thermal property, abrasion resistance, chemical resistance, corrosion resistance, dimensional stability, etc. can be boiled markedly, and it can improve.

[0057] Moreover, in the set material 1 concerning this invention, compression-molding equipment 40 can perform fixed processing, and permanent fixation equipment 70 can perform permanent fixation processing compression-molding processing and temporarily. From this, one equipment with a complicated device can be transposed to two simple equipments like before, and the burden of an activity or a maintenance can be mitigated. Moreover, use of an existing facility is also attained.

Furthermore, it becomes possible to be able to improve effectiveness in equipment, such as volume and heat, and to deal with a lot of set material 1. The low set material 1 of cost can be extremely manufactured by these. In addition, although the hide of the thinning material 2 uses that which is decorticated by high-pressure water, a disk cutter, etc. in many cases, ** cost-ization can also be further advanced by processing in the condition [that the hide has stuck] and manufacturing the set material 1. [0058]

[Example]

(Example)

(1) The boiling water 21 heated in the tank 20 in two Japan cedar green wood of the diameter of 4cm, die length of 20cm, and specific gravity 0.8 (specific gravity under oven-dry 0.4) was kept at 98 degrees C for 1 hour, and softening processing was performed.

(2) After it filled up the press metal mold 41 of compression-molding equipment 40 with two wood by which softening processing was carried out and the cross section compressed it to 1.4cm(thickness) x7.0cm (width of face) (about 60% of compressibility), compression-molding processing by the overcompression which returns the press metal mold 42 gradually to the compressive (about 30% of compressibility) location where the cross section of wood becomes 2.5cm(thickness) x7.0cm (width of face) was performed. Then, maintained the press metal mold 41 and 42 at 150 degrees C for 1 hour, dried wood, and picked out the press metal mold 41 and the press metal mold 41 and 42 in the condition of having held by the clamp 50 the whole 42 and having been held by the clamp 50 after that which sandwiched wood from compression-molding equipment 40, and left it for 90 minutes in ordinary temperature, wood was made to cool, and fixed processing was performed temporarily which obtains the wood with which temperature became 30 degrees C.

(3) To the front face of two wood by which fixed processing was carried out temporarily, they are 250g - 300 g/m2 with the brush. Spreading processing of the REJIRUSHI Norian resin adhesives of extent was performed.

(4) two wood by which spreading processing was carried out was picked out from compression-molding equipment 40 in (3) which fixed 4th page other than a cross-section-of-wood side -- in the condition, the steam was injected inside permanent fixation equipment 70, it kept at 180 degrees C for 30 minutes, permanent fixation processing was performed, and set material was obtained.

[0059] (5) The next trial was performed about the set material obtained in this way. In addition, the test result is shown in Table 1.

a) Water absorption thickness expansion coefficient JIS A According to 5908 (particle board), a test piece is immersed in underwater [25**1-degree C] for 24 hours, and the thickness after processing is measured and computed.

$$\text{吸水厚さ膨張率 (\%)} = \frac{t_2 - t_1}{t_1} \times 100$$

t1 Thickness before water absorption (mm)

t2 Thickness after water absorption (mm)

b) Bond strength (block shear strength)

the test piece shown in drawing 9 according to JAS specification (laminated lumber) block shear test -- loading speed -- per minute 1000 kgf is made to fracture as a criterion

試験片が破断したときの荷重

$$\text{せん断強度 (kgf/cm}^2\text{)} = \frac{\text{試験片が破断したときの荷重}}{\text{接着面積}}$$

[0060] (Example of a comparison)

(1) Softening processing of wood was performed by injecting a steam inside and keeping the two wood concerned which decorticated the Japan cedar green wood of the tip diameter of 10cm, the diameter of a

tip diameter of 12cm, die length of 3m, and specific gravity 0.8 (it is 0.4 at an air dried state) at 150 degrees C within the steam heating apparatus 10, for 1 hour.

(2) Take out wood after softening processing and from the inside of the steam heating apparatus 10, and it is resorcinol resin adhesive with the brush to a wood front face 250 - 300 g/m² Extent spreading was carried out.

(3) Carrying out configuration maintenance, after filling up the press metal mold in compression-molding equipment (it differs from this invention) with two wood which applied resorcinol resin adhesive and carrying out pressurization compression (50% of compressibility) to 30x30cm of cross sections, the steam was injected, by keeping at 180 degrees C for 60 minutes, fixed processing was performed and set material was obtained.

(4) About the set material obtained in this way, the trial of (a) and (b) in the above-mentioned example was performed. A test result is shown in Table 1. Moreover, the obtained set material was specific gravity 0.8 [about].

[0061]

[Table 1]

| | 実施例 | 比較例 |
|---|------|-----|
| 成形体比重 | 0.6 | 0.6 |
| 曲げ強度 (kgf/cm ²) | 1100 | 850 |
| 硬さ (kgf/mm ²) | 2.5 | 2.0 |
| 吸水厚さ膨張率 (%) | 5.5 | 9.0 |
| 接着強度 (ブロックせん断強度) (kgf/cm ²) | 140 | 110 |

[0062] When the test result obtained from said example and the test result obtained from the example of a comparison are explained by comparison here, about Plastic solid specific gravity, the specific gravity (1.1) of an example is larger than the specific gravity (0.8) of the example of a comparison a little first. In order to perform heat-treatment by steam under pressure in the condition with many moisture contents of each wood at the set material in the example of a comparison While it is thought that destruction of the internal organization of each wood, and a crack and a blowout occurred, and the specific gravity of each wood fell as a result, in the set material of an example In order to change the moisture content of each wood into few conditions by desiccation and to perform heat-treatment by steam under pressure, destruction of the internal organization of each wood and generating of a crack or a blowout are prevented, and it is thought that it is based on the wood organization having become precise rather than the example of a comparison as a result.

[0063] moreover -- flexural strength -- the flexural strength of an example -- 2100 kgf/cm² it is in the range -- receiving -- the flexural strength of the example of a comparison -- 1030 kgf/cm² it is -- according to the example, it turns out that one about 2.0 times the flexural strength of the example of a comparison is obtained. That thus, the flexural strength in an example becomes the magnitude which is twice [about] the flexural strength of the example of a comparison In order to perform heat-treatment by steam under pressure in the condition with many moisture contents of each wood at the set material in the example of a comparison destruction of the internal organization of each wood etc. -- generating -- the flexural strength of each wood itself -- having fallen -- ** -- thinking -- having -- while -- an example -- in set material In order to change the moisture content of each wood into few conditions by desiccation and to perform heat-treatment by steam under pressure Destruction of the internal organization of each wood and generating of a crack or a blowout will be prevented, the flexural strength of each wood itself will become large, and it will contribute to improvement in the flexural strength of set material greatly. Therefore, the flexural strength of set material is considered based on the adhesive strength of the adhesives which bind each wood becoming large conjointly as a whole.

[0064] Furthermore, when its attention is paid to hardness, the hardness of the set material in an example is 2 4.3 kgf/mm to the hardness of the set material concerning the example of a comparison being 2 2.7 kgf(s)/mm. It turns out that it is in the range and big hardness is obtained compared with the example of a comparison. In the example, destruction of the internal organization of each wood in set material etc. is prevented, the hardness of each wood improves, and this is also considered that hardness high as the whole set material was obtained.

[0065] Moreover, to being 11.9%, in the example, it is in 5.5% of range, and it turns out about a water absorption thickness expansion coefficient that it is about 1 of example of comparison/2 at the set material of the example of a comparison. This is also considered by preventing destruction of the internal organization of each wood etc. by the set material of an example based on the water absorption inside [each] wood becoming lower than the example of a comparison. This shows that the set material of an example excels the set material of the example of a comparison in dimensional stability and configuration stability.

[0066] About bond strength, between an example and the example of a comparison, it is almost same, and it understands that the bond strength (150 kgf/cm²) of the set material in an example is larger than the bond strength (110 kgf/cm²) of the set material in the example of a comparison a little.

[0067] In addition, as for this invention, it is needless to say for amelioration various by within the limits which is not limited to said example and does not deviate from the summary of this invention and deformation to be possible. For example, in the set material 1 concerning this example, if various configurations of each press metal mold 41 and 42 used for said compression-molding equipment 40 are changed although explained taking the case of rectangular parallelepiped-like set material as shown in drawing 1 , it will be in ** that the set material which has various kinds of request configurations is obtained.

[0068]

[Effect of the Invention] This invention prevents destruction of the internal organization of set material by desiccation in fixed processing temporarily, raises the quality of set material, and the increase in efficiency of the activity by separation of a manufacturing installation and easy-ization of the maintenance of a manufacturing installation are carried out by installation of fixed processing temporarily, and it raises mass-production nature as explained above. Therefore, the effectiveness which is quality, can offer the manufacture approach that the set material of low cost can be obtained, and does so on the industry is size.

[Translation done.]

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CLAIMS

[Claim(s)]

[Claim 1] The 2nd process which performs fixed processing temporarily the water content of each wood is temporarily reduced, performing compression-molding processing with predetermined compressibility after ****(ing) each softened wood to the same grain direction, the 1st process which performs softening processing of two or more wood, and, The manufacture approach of set material which consists of the 3rd process which performs spreading processing of adhesives on the front face of each wood fixed temporarily, and the 4th process which performs permanent fixation processing of an aggregate configuration while hardening the adhesives applied to each wood, unifying each wood and forming the aggregate.

[Claim 2] The manufacture approach of the set material of claim 1 characterized by being returned to predetermined compressibility after carrying out the overcompression of said each wood based on compressibility higher than said predetermined compressibility in the compression-molding processing in said 2nd process.

[Claim 3] The manufacture approach of the set material of claim 1 characterized by performing cooling after desiccation of said each wood by fixed processing temporarily in said 2nd process.

[Claim 4] It is the manufacture approach of the set material of claim 1 characterized by being carried out through compression-molding equipment with the fixed processing same temporarily with the compression-molding processing in said 2nd process.

[Claim 5] The manufacture approach of the set material of claim 1 characterized by performing heating of said each wood through steam under pressure in the permanent fixation processing in said 4th process.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the perspective view showing set material typically.

[Drawing 2] It is the explanatory view showing typically the condition that steam heating apparatus performs softening (heating) processing of thinning material.

[Drawing 3] It is the explanatory view showing typically the condition of performing softening (heating) processing of the thinning material by boiling in the tank which filled boiling water.

[Drawing 4] It is the explanatory view showing typically the condition that high-frequency-heating equipment performs softening (heating) processing of thinning material.

[Drawing 5] It is the explanatory view showing typically the condition before compression-molding equipment performs compression-molding processing of thinning material.

[Drawing 6] It is the explanatory view showing typically the condition of performing fixed processing the condition that compression-molding equipment performs compression-molding processing of thinning material, and temporarily.

[Drawing 7] It is drawing explaining the condition of having held the configuration in compression-molding processing of thinning material by the clamp.

[Drawing 8] It is the explanatory view showing typically the condition of performing permanent fixation processing of thinning material in the condition of having held in the predetermined configuration with permanent fixation equipment.

[Drawing 9] It is the mimetic diagram showing the configuration of a test piece.

[Description of Notations]

1 Set Material

2 Thinning Material

3 Adhesives

10 Steam Heating Apparatus

20 Tank

21 Boiling Water

30 High-frequency-Heating Equipment

33 RF Oscillation Machine

40 Compression-Molding Equipment

41 42 Press metal mold

45 46 Planar heating element

47 48 Evaporation hole

49 Aggregate

50 Clamp

70 Permanent Fixation Equipment

71 Proof-Pressure Container

A-A' Location corresponding to predetermined compressibility

B-B' Location corresponding to compressibility higher than predetermined compressibility

N Annual-rings pattern

[Translation done.]